Hydrol. Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/hess-2018-391-SC1, 2018

Hydrology and Earth System Sciences Discussions

HESSD

Interactive comment

Interactive comment on "On the choice of calibration metrics for "high flow" estimation using hydrologic models" *by* Naoki Mizukami et al.

J Ding

johnding_toronto@yahoo.com

Received and published: 16 August 2018

The NSE criterion

Having had taken a postgraduate-level course from Nash (1968-69) when he was a visiting professor at my alma mater, the University of Guelph in Ontario, Canada, I believe I was privy to his thinking behind the development of the NSE criterion, a variant of the sum of squared error measure (Nash and Sutcliffe, 1970).

I could be wrong because of the passage of time, but his thinking was that in the absence of a model, the best estimate of the future flows was the average or mean observed flow value $\overline{O}$, thus its appearance in the denominator of the criterion below (e.g., Ding, 1974, Equation 47):

$$R^2 = 1 - F/F_0, \tag{1}$$

$$F_0 = \sum_{t=0}^{L-1} (Q_{t+1} - \overline{O})^2, \tag{2}$$

$$F = \sum_{t=0}^{L-1} (Q_{t+1} - O_{t+1})^2, \tag{3}$$

in which R^2 is the model efficiency; F_0 and F are the initial variance from the mean value and the residual variance from the observed values, respectively; O and Q are the observed and simulated flow series, respectively; t is the index of timestep Δt; and L is the length, or number of ordinates, of the observed hydrograph.

To my way of thinking then, a better estimator would instead be based be a one-step-ahead forecast, $\hat{O}_{t+1} = O_t + (O_t - O_{t-1})$. Replacing the $\overline{O}$ term in Equation (2) by $\hat{O}_{t+1}$ produces Equations (4) and (5):

$$F_1 = \sum_{t=0}^{L-1} (Q_{t+1} - \hat{O}_{t+1})^2, \tag{4}$$

$$R_1^2 = 1 - F/F_1, \tag{5}$$

This would make F_1 smaller in value than F_0, and the modified NSE criterion, R_1^2, a lower score one. The drawback was to always overshoot, by one timestep, the turning points, the peaks and troughs of an observed hydrograph.

References

Ding, J. Y.: Variable unit hydrograph, J. Hydrol., 22, 53-69, 1974.

Nash, J. E.: A course of lectures on parametric or analytical hydrology. Great Lakes Institute, University of Toronto, Ont., PR 38, 1968-69.

Nash, J.E. and Sutcliffe, J.V.: River flow forecasting through conceptual models, part I - A discussion of principles, J. Hydrol., 10(3), 282-290, 1970.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2018-391, 2018.